

418 Rec'd PCT/PTO 23 DEC 1999

09/446623

Practitioner's Docket No. SWR-0004

CHAPTER II

TRANSMITTAL LETTER
TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/EP97/03309	June 24, 1997	December 30, 1998
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
<u>METHOD OF PRODUCING A COATING FOR ABSORBING NEUTRONS</u>		
TITLE OF INVENTION		
Klaus-Leo Wilbuer		
APPLICANT(S)		

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231

ATTENTION: EO/US

NOTE: The completion of those filing requirements that can be made at a time later than 30 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 U.S.C. § 371(c). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 C.F.R. § 1.491 which states: "An international application enters the national state when the applicant has filed the documents and fees required by 35 USC 371(c) within the periods set forth in § 1.494 and § 1.495."

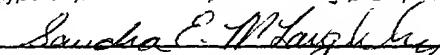
CERTIFICATION UNDER 37 C.F.R. § 1.10*

(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date December 23, 1999, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL380644291US, addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Sandra E. McLaughlin

(type or print name of person mailing paper)



Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.3 cannot be used to obtain a date of mailing or transmission for this correspondence.

*WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

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WARNING: Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F.R. § 1.8).

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111, 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

- a. This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).
- b. The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

09/446623

2. Fees

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CLAIMS FEE	(1) FOR FILED	(2) NUMBER EXTRA	(4) RATE	(5) CALCULATI- ONS
<input checked="" type="checkbox"/> TOTAL CLAIMS	13 - 2 =		x \$18.00	\$
<input checked="" type="checkbox"/> INDEPENDENT CLAIMS	2 - 3 =		x \$78.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+\$260.00
BASIC FEES:				
<input checked="" type="checkbox"/> U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY	Where an International preliminary examination fee is set forth in § 1.482 has been paid to the International Searcher to the U.S. PTO:			
<input type="checkbox"/>	and the International preliminary examination report stated that the criteria of novelty, inventiveness and non-obviousness and industrial activity, as defined in PCT Article 32(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) \$98.00			
<input type="checkbox"/>	and the above requirements are not met 37 CFR 1.492(a)(1) \$670.00			
<input checked="" type="checkbox"/> U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY	Where no International preliminary examination fee is set forth in § 1.482 has been paid to the U.S. PTO, and payment of an International search fee as set forth in § 1.445(a)(2) to the U.S. PTO:			
<input type="checkbox"/>	has been paid (37 CFR 1.492(a)(2)) \$760.00			
<input type="checkbox"/>	has not been paid (37 CFR 1.492(a)(3)) \$970.00			
<input checked="" type="checkbox"/> XX	where a search report on the International application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) \$840.00			
Total of above Calculations = \$840.00				
Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 CFR 1.3, 1.27, 1.29)				
Subtotal \$840.00				
Total National Fee \$840.00				
Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See item 13 below). See attached 'ASSIGNMENT COVER SHEET'.				
TOTAL	Total Fees enclosed \$840.00			

*See attached Preliminary Amendment Reducing the Number of Claims.

- i. A check in the amount of \$40.00 to cover the above fees is enclosed.
- ii. Please charge Account No. _____ in the amount of \$ _____.
A duplicate copy of this sheet is enclosed.

WARNING: To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: *(*) (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495(b).

WARNING: If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

3. A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date. * Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

- a. is transmitted herewith.
- b. is not required, as the application was filed with the United States Receiving Office.
- c. has been transmitted
 - i. by the International Bureau.
Date of mailing of the application (from form PCT/1B/3C6): _____
 - ii. by applicant on _____
Date

4. A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

- a. is transmitted herewith.
- b. is not required as the application was filed in English.
- c. was previously transmitted by applicant on _____
Date
- d. will follow.

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5. Amendments to the claims of the International application under PCT Article 19
(35 U.S.C. § 371(c)(3)):

NOTE: The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

a. are transmitted herewith.

b. have been transmitted

- i. by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): _____
- ii. by applicant on (date) _____
Date

c. have not been transmitted as

- i. applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210): _____
- ii. the time limit for the submission of amendments has not yet expired.
The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. A translation of the amendments to the claims under PCT Article 19
(38 U.S.C. § 371(c)(3)):

- a. is transmitted herewith.
- b. is not required as the amendments were made in the English language.
- c. has not been transmitted for reasons indicated at point 5(c) above.

7. A copy of the international examination report (PCT/IPEA/409)

is transmitted herewith.

is not required as the application was filed with the United States Receiving Office.

8. Annex(es) to the international preliminary examination report

- a. is/are transmitted herewith.
- b. is/are not required as the application was filed with the United States Receiving Office.

9. A translation of the annexes to the international preliminary examination report

- a. is transmitted herewith.
- b. is not required as the annexes are in the English language.

10. An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

- a. was previously submitted by applicant on _____ Date

- b. is submitted herewith, and such oath or declaration
 - i. is attached to the application.
 - ii. identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.
 - iii. will follow.

II. Other document(s) or information included:

11. An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

- a. is transmitted herewith.
- b. has been transmitted by the International Bureau.
Date of mailing (from form PCT/IB/308): _____
- c. is not required, as the application was searched by the United States International Searching Authority.
- d. will be transmitted promptly upon request.
- e. has been submitted by applicant on _____ Date

12. An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

- a. is transmitted herewith.
Also transmitted herewith is/are:
 Form PTC-1449 (PTC/SB/02A and 02B).
 Copies of citations listed.
- b. will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).
- c. was previously submitted by applicant on _____ Date

13. An assignment document is transmitted herewith for recording.

A separate "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or FORM PTO 1595 is also attached.

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14. Additional documents:

- a. Copy of request (PCT/RC/101)
- b. International Publication No. WO 98/59344
 - i. Specification, claims and drawing
 - ii. Front page only
- c. Preliminary amendment (37 C.F.R. § 1.121)
- d. Other

15. The above checked items are being transmitted

- a. before 30 months from any claimed priority date.
- b. after 30 months.

16. Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, recurring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.126(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.126(a).

The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 06-1130

37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: Because failure to pay the national fee within 30 months without extension (37 CFR § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.

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37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid for these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

37 C.F.R. § 1.17 (application processing fees)

37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notices of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).



SIGNATURE OF PRACTITIONER

Edward J. Ellis

(type or print name of practitioner)

CANTOR COLBURN LLP

P.O. Address

88 Day Hill Road, Windsor, CT 06095

Reg. No.: 40,389
Tel. No.: (860) 688-4470

Customer No.:

(Transmittal Letter to the United States Patent Office (USPTO) [13-18]—page 3 of 3)

CANTOR COLBURN LLP

55 Griffis Road South
Bloomfield, CT 06002
860-286-2929

Applicant or Patenice: KLAUS-LEO WILBUER

Serial or Patent No: 09/446,623 Attorney's Docket No: SWR-0004

Filed or Issued: December 23, 1999 For: METHOD OF PRODUCING A COATING
FOR ABSORBING NEUTRONS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27 (c)) - SMALL BUSINESS CONCERN

I hereby declare that I am:

the owner of the small business concern identified below;
 an official of the small business concern empowered to act on behalf of the
concern identified below.

NAME OF CONCERN: CNB Gesellschaft für Nuklear-Behälter mbH
ADDRESS OF CONCERN: Hollerallee 7A 45127 Essen, Germany

I hereby declare that the above-identified small business concern qualified as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that under contract or law all right, title and interest in and to the following invention have been conveyed to and remain exclusively in the small business concern identified above, said invention, entitled: METHOD OF PRODUCING A COATING FOR ABSORBING NEUTRONS by inventor(s) Klaus-Lee Wilbuer, Hermann Hans Urlberger, Rudolf Diersch, Hermann Stelzer, Matthias Patzelt, Dieter Metzling described in

the specification filed herewith
 Application Serial No. 09/446,623 filed: December 23, 1999
 Patent No. _____, issued: _____

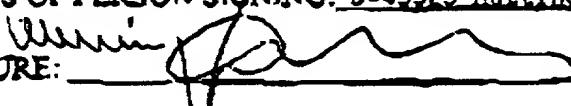
I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of issue fee or any maintenance fee due after date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Dieter Methling Wolfgang Sowa

TITLE OF PERSON, OTHER THAN OWNER: Managing Director Managing Director

ADDRESS OF PERSON SIGNING: Kehre 9 Emilstraße 105
D-45525 Hattingen D-44869 Bochum

SIGNATURE:  DATE: 18.02.2000

CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
860-286-2929

Applicant or Patentee: KLAUS-LEO WILBUER

Serial or Patent No: 09/446,623 Attorney's Docket No: SWR-0004

Filed or Issued: December 23, 1999 For: METHOD OF PRODUCING A COATING
FOR ABSORBING NEUTRONS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27 (c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

the owner of the small business concern identified below;
 an official of the small business concern empowered to act on behalf of the
concern identified below.

NAME OF CONCERN: Metallveredlung GmbH & Co. KG

ADDRESS OF CONCERN: Gillicher Straße 14, 42699 Solingen, Germany

I hereby declare that the above-identified small business concern qualified as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that under contract or law all right, title and interest in and to the following invention have been conveyed to and remain exclusively in the small business concern identified above, said invention, entitled: METHOD OF PRODUCING A COATING FOR ABSORBING NEUTRONS by inventor(s) Klaus-Leo Wilbuer, Hermann Hans Urlberger, Rudolf Diersch, Hermann Stelzer, Matthias Patzelt, Dieter Methling described in

the specification filed herewith
 Application Serial No. 09/446,623, filed: December 23, 1999
 Patent No. _____, issued: _____

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of issue fee or any maintenance fee due after date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Klares Leo Wulbuer

TITLE OF PERSON, OTHER THAN OWNER: Geschäftsführer

ADDRESS OF PERSON SIGNING: Fesunohlheitstr. 14a, 42699 Solingen

SIGNATURE: L. Wulbuer DATE: 17.02.00

09/446623

410 Rec'd PCT/PTO 23 DEC 1999

Via Express Mail Label:EL380644291US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: KLAUS-LEO WILBUER

FOR: METHOD FOR PRODUCING A COATING FOR ABSORBING NEUTRONS

PRELIMINARY AMENDMENT

Box PCT
The Assistant Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Sir:

Prior to the Examiner acting in the above-referenced application, please preliminarily amend the claims and specification as follows:

IN THE SPECIFICATION:

In the Abstract, please add the Abstract as appended hereto.

Page 1, between lines 3-4, please insert –TECHNICAL FIELD–.

Page 1, between lines 6-7, please insert –BACKGROUND OF THE INVENTION–.

Page 3, between lines 6-7, please insert –DETAILED DESCRIPTION OF THE INVENTION–.

IN THE CLAIMS:

Claim 2, line 1, delete “characterized by the fact that” and substitute
—wherein—.

Claim 3. (Amended) The method [in one of the preceding Claims,
characterized by the fact that] as set forth in Claim 1, wherein the surface to be coated
is arranged face up in the dispersion bath.

Claim 4. (Amended) The method [in one of the preceding Claims,
characterized by the fact that] as set forth in Claim 1, wherein a dispersion bath with
boron carbide is used.

Claim 5. (Amended) The method [in one of the preceding Claims,
characterized by the fact that] as set forth in Claim 1, wherein a dispersion bath with
boron in elemental form is used.

Claim 6. (Amended) The method [in one of the preceding Claims,
characterized by the fact that] as set forth in Claim 1, wherein the coating is formed
chemically.

Claim 7. (Amended) The method [in one of Claims 1 to 5, characterized by the fact that] as set forth in Claim 1, wherein the coating is formed electrolytically.

Claim 8. (Amended) The method [in one of the preceding Claims, characterized by the fact that] as set forth in Claim 1, wherein a coating 350 to 500 μm thick is produced.

Claim 9. (Amended) The method [in one of the preceding Claims, characterized by the fact that] as set forth in Claim 1, wherein boron or boron carbide with more than 20% by volume is embedded in the nickel matrix.

Claim 10. (Amended) The method [in one of the preceding Claims, characterized by the fact that] as set forth in Claim 1, wherein boron or boron carbide with more than 40% by volume is embedded in the nickel matrix.

Claim 11. (Amended) The method [in one of the preceding Claims, characterized by the fact that] as set forth in Claim 1, wherein the dispersion bath is mixed, at least from time to time, during the coating process.

Claim 12. (Amended) The method [in one of the preceding Claims, characterized by the fact that] as set forth in Claim 1, wherein the method is carried out in a glass tub.

Claim 13. (Amended) A shielding element produced by [the method in at least one the preceding Claims,] producing a coating for the absorption of neutrons created in a nuclear reaction of radioactive materials, where at least part of a shielding element composed of a basic material is provided on a surface predetermined for it with a boron-nickel coating in a dispersion bath containing boron, and during the coating process, at least from time to time, a relative movement is produced between the surface to be coated and the dispersion bath, wherein the shielding element is [characterized by the fact that it is] composed of an inorganic basic material with a boron/nickel coating on top, where the coating contains more than 20% boron or boron carbide by volume.

REMARKS

Applicants request entry of the above-identified amendments which, in part, reduce multiple dependencies and conform the claims to U.S. practice. No new matter is being introduced by this Amendment as antecedent support is set forth in the specification and the original claims.

Prosecution on the merits is respectfully requested.

If there are any charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,
KLAUS-LEO WILBUER
CANTOR COLBURN LLP
Applicants' Attorneys

By: 
Edward J. Ellis
Registration No. 40,389

Date: December 23, 1999
Address: 88 Day Hill Road, Windsor, Connecticut 06095
Telephone: (860) 688-4470

Abstract

The object of the invention is to provide a process for producing a coating for absorbing the neutrons which result from the nuclear reaction of radioactive materials. This process should be economic and easy to apply, the absorption effectiveness should be increased, a greater diversity of base materials and shielding element shapes should be made possible and, in particular, the process should allow lighter shielding elements with at least the same absorption qualities to be produced. According to the disclosed process for producing shielding elements for absorbing the neutrons which result from the nuclear reaction of the radioactive materials, a boron-nickel layer is applied in a boron-containing dispersion bath to at least part of a shielding element made of a base material, on at least one of its shielding surfaces. During the coating process, a relative movement between the surface to be coated and the dispersion bath is generated for at least part of the time.

WO 98/59344

PCT/EP97/03309

METHOD OF PRODUCING A COATING FOR ABSORBING NEUTRONS

The invention concerns a method of producing a coating to absorb neutrons created in the nuclear reaction of radioactive materials. The invention also concerns a shielding element produced by the method.

For the treatment of radioactive materials, especially those coming from the field of nuclear reactor technology, these materials are shielded from one another by forcibly beamed neutrons, depending on the job, material and condition, for example when changing and/or testing and for transport and/or storage, to prevent further nuclear reactions. To achieve the desired neutron absorption, absorber elements in the form of various types of shafts, canisters, tubes or similar configurations are usually produced that surround an object emitting neutrons and thus shield it. The use of such absorber elements permits compact storage of elements that give off neutrons, especially fuel elements from nuclear power plants, for example.

A storage rack for fuel elements is known from EP 0 385 187 A1 in which absorber sheets form a number of shafts that surround the burning element over its entire length. These absorber elements are shafts or tubes made of a material that absorbs neutrons, for example, boron steel, a high-grade steel with 1% to 2% boron. Apart from the necessary production expense, these absorber elements are extremely cost-intensive and their effectiveness is limited due to the limited proportion of boron. In an attempt to increase the proportion of boron, the deposition of a boron-nickel alloy was studied. The proportion of boron can be raised to 8%, but the costs also increase by a factor of 10, so such tubes cannot be used economically.

For other jobs, for example transport and/or storage of radioactive materials, methods are used in which nickel coatings are deposited on the metal surfaces of containers.

US-PS 4 218 622 describes a composite absorber element which has a thin carrier film or a thin carrier sheet to which a polymer matrix is applied that has boron carbide particles embedded in it. Preferably, fiberglass-reinforced polymer is used as the material for the carrier film or carrier sheet. The boron carbide particles are distributed evenly on the surface of the polymer matrix, with a boron concentration of up to 0.1 g/cm². When the composite absorber part is used in a fuel element storage rack, this absorber element has a thickness of up to 7 mm, is designed in the form of a film or sheet and is suspended between an inner wall and an outer wall. Whether homogeneous distribution of the boron carbide particles arranged on the surface of the polymer matrix is guaranteed over a longer period of time, especially if there is friction on the surface, cannot be inferred from US-PS 4 218 622.

EP 0 016 252 A1 describes a method of producing an absorber element that absorbs neutrons. In this method, boron carbide is applied to a substrate along with a metal substance by means of plasma spraying,

and the boron carbide is embedded in a matrix made of a metal substance. The method is also carried out so as to avoid oxidation of the boron. The absorber element produced in this way should be stable vis-à-vis a liquid medium like what exists in a fuel element storage basin, for example. The thickness of the layer of metal and boron carbide applied by means of plasma spraying is at least 500 µm. The proportion of boron carbide is roughly 50% by volume. Aluminum, copper and stainless steel can be considered for the metal substance, and the substrate contains the same metal substance as the sprayed-on layer. A relatively thick coating of boron carbide is necessary for effective neutron absorption; the thickness of the layer is 3 to 6 mm, in particular.

It is known from DE-AS 1 037 302 and DE 2 361 363 how to provide tubes, especially tin cans, with absorber material on their outer surface by electrolytic methods to protect them from radioactive radiation. There is no information on the engineering processes and equipment for technical implementation of physical-chemical changes in status and conversion of materials for applying the absorber materials that can be obtained from DE-AS 1 037 302 and DE 2 361 363.

Methods of producing shielding elements are known from EP 0 055 679 A2 in which boron carbide is either placed on the surface of the shielding element in a plasma-coating method or after electrolytic or chemical preliminary nickel plating of the shielding element, boron carbide is sprinkled in powder form on the surface and the shielding element is then nickel-plated electrolytically or chemically afterward. In this method, only small amounts of boron carbide, on the order of 20% by weight in relation to the nickel, are applied to the surface. Very heavy coatings are therefore needed, so these previously known methods are not economical. In practice, these methods are not further used, since they cannot be specifically engineered. Applying powder to a surface by sprinkling is not a measure that guarantees secure industrial production.

All the previously known methods and the shielding elements produced by them can be regarded as uneconomical in terms of high production costs and a large expenditure of materials. Moreover, the variability of the form of the shielding element and the expansion of potential uses are limited.

Production of boron steel is extremely expensive. The steel is smelted and boron is enriched by expensive methods up to a valence of 10 and mixed with the smelted steel. This yields boron steel with 1.1% to 1.4% boron by weight. This steel is very hard to work with, is extremely brittle and is difficult to solder. Shielding elements made from it are extremely heavy with average absorption properties. For example, inner storage containers, such as baskets for interim storage of fuel elements are known that are made of boron steel and weigh approximately 10 tons.

Starting from the previously known state of the art, the problem of this invention is to specify a method of producing a coating or shielding elements to absorb the neutrons created in a nuclear reaction of radioactive materials that is economical and easy to use, which increases the effectiveness of the absorption, permits greater variability in terms of the basic materials and the shape of the shielding elements and especially permits production of lighter shielding elements that have at least the same absorption qualities.

A method of producing a coating to absorb the neutrons created in a nuclear reaction of radioactive materials is proposed for the technical solution of this problem in which at least part of a shielding element composed of a basic material is provided with a boron-nickel layer on its predetermined surfaces in a dispersion bath containing boron, and during the coating process a relative movement is produced between the surface to be coated and the dispersion bath, at least for a time.

Surprisingly, it has been shown that the design of a boron-nickel coating in a dispersion bath with relative movement for a time between the surface to be coated and the dispersion bath gives very good results. In contrast to the embedding done in the past, the boron can be inserted into the nickel matrix in magnitudes $>20\%$ by volume or even $\geq 40\%$ by volume. The boron can be contained in the dispersion as boron carbide (B_4C) or, according to one especially advantageous proposal in the invention, as boron in elemental form. When elemental boron is used, even more boron can be embedded.

Thus, because of the high embedding rates, there is much greater effectiveness. The absorption layers are on the order of 350 to 500 μm , which is extremely thin. Moreover, one special advantage is the method's independence from the basic material. It is an advantage that inorganic basic material can be used, for example steel, titanium, copper, nickel and the like. Despite its organic character and hence susceptibility to neutron radiation, carbon fiber material can be considered as a basic material. Carbon fiber material has the special advantage that the absorption element can be produced by galvanizing technology.

The invention also offers the possibility of making the shielding element in the finished state or in individual parts. Because of its independence from the basic material, materials that are very easy to work with can be used. On the other hand, very complicated forms of shielding elements, containers, baskets and the like can also be prefabricated completely and then coated according to the invention.

Because of the high embedding rate, the shielding is extremely effective, so the coatings can be extremely thin. Thus, weight savings up to 80% compared to shielding elements that can be produced by the conventional methods are possible. The former 10-ton inner storage containers (baskets) now used in the so-called Castor Program for storing fuel elements can be produced by the method in the invention on the order of 2.5 to 3 tons now.

The basic material can be prefabricated as a finished part or as individual parts, so that finished shielding elements can be made from individual parts. They are coated either chemically or electrolytically in the dispersion bath.

The relative movement between the surface to be coated and the dispersion bath can be brought about, for example, by moving the element to be coated in the dispersion bath. As is known, elements like boron can be constituted so that recirculating or pumping the dispersion is not economically possible in practice. Any recirculating or pumping unit would be worn out in a short period of time. Nevertheless, relative movement, on one hand, achieves continuously good mixing or repeated mixing of the dispersion, and on the other hand, directly taking the dispersion to the surface to be coated. Besides moving the element, the whole coating system can also be moved for the purpose of producing the relative movement. Thus, coating can conceivably take place in a type of drum, for example.

It is a special advantage proposed with the invention that the surface to be coated is arranged pointing upward in the dispersion bath. This means that the surface to be coated is arranged in the dispersion bath in such a way that because of the force of gravity, the particles found in the dispersion fall on the surface. This arrangement in the invention, especially in combination with the production of relative movement between the surface and the dispersion bath from time to time, gives outstanding coating results.

The invention offers the special advantage that the coating method is carried out in a glass tub. This guarantees special purity of the dispersion bath.

The invention provides a simple, economical and very effective method of producing shielding elements for neutron absorption, which makes it possible to produce shielding elements independent of the basic material that are much lighter than the known shielding elements with comparable absorption effects.

The invention also concerns shielding elements produced by the method described. They are characterized by the fact that they have a boron-nickel coating, with a proportion of boron in elemental form or boron carbide greater than 20% by volume or 40% by volume. The thickness of the coating is 350 to 500 μm , and the coating is done on an inorganic basic material such as steel, titanium, copper or the like. The process is chemical or electrolytic. The shielding element can be coated in finished form or can be put together from individually coated parts.

In one experiment, conventional steel plates were coated electrolytically in a nickel/boron carbide dispersion bath. The plates were all turned every half hour in the bath and moved up and down from time to time in order to produce a relative movement between the surface and the dispersion bath, on one hand,

and to arrange the surface to be coated face up in the bath, on the other. Boron carbide in the range of 40% by volume was able to be embedded in the nickel matrix, as subsequent analyses revealed.

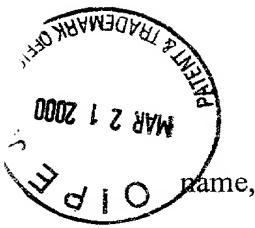
Patent Claims

1. A method of producing a coating for the absorption of neutrons created in a nuclear reaction of radioactive materials, where at least part of a shielding element composed of a basic material is provided on a surface predetermined for it with a boron-nickel coating in a dispersion bath containing boron, and during the coating process, at least from time to time, a relative movement is produced between the surface to be coated and the dispersion bath.
2. The method in Claim 1, characterized by the fact that the relative movement is produced by moving the element to be coated.
3. The method in one of the preceding Claims, characterized by the fact that the surface to be coated is arranged face up in the dispersion bath.
4. The method in one of the preceding Claims, characterized by the fact that a dispersion bath with boron carbide is used.
5. The method in one of the preceding Claims, characterized by the fact that a dispersion bath with boron in elemental form is used.
6. The method in one of the preceding Claims, characterized by the fact that the coating is formed chemically.
7. The method in one of Claims 1 to 5, characterized by the fact that the coating is formed electrolytically.
8. The method in one of the preceding Claims, characterized by the fact that a coating 350 to 500 μm thick is produced.
9. The method in one of the preceding Claims, characterized by the fact that boron or boron carbide with more than 20% by volume is embedded in the nickel matrix.
10. The method in one of the preceding Claims, characterized by the fact that boron or boron carbide with more than 40% by volume is embedded in the nickel matrix.
11. The method in one of the preceding Claims, characterized by the fact that the dispersion bath is mixed, at least from time to time, during the coating process.

12. The method in one of the preceding Claims, characterized by the fact that the method is carried out in a glass tub.
13. A shielding element produced by the method in at least one of the preceding Claims, characterized by the fact that it is composed of an inorganic basic material with a boron/nickel coating on top, where the coating contains more than 20% boron or boron carbide by volume.

W. G. C.
2002-03-17
650655

DECLARATION AND POWER OF ATTORNEY



As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my/our name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled PROCESS FOR PRODUCING A NEUTRON-ABSORBING COATING the specification of which

(check one)

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was filed on _____ as

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(if applicable)

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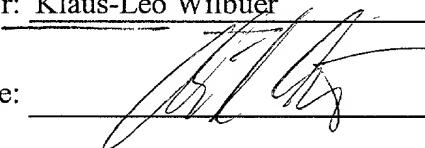
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Michael A. Cantor - Registration No. 31,152
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Keith J. Murphy - Registration No. 33,979
Leah M. Reimer - Registration No. 39,341
David A. Fox - Registration No. 38,807
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Direct Telephone Calls To:
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Philmore H. Colburn II
(860) 688-4470

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor: Klaus-Leo Wilbuer

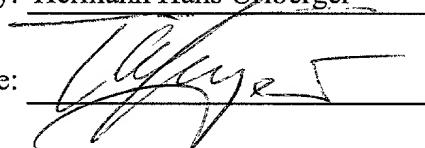
Inventor's signature:  Date 22/11/99

Residence: Gesundheitsstraße 14a, 42699 Solingen 

Citizenship: German

Post Office Address: Gesundheitsstraße 14a, 42699 Solingen

Full name of second inventor: Hermann Hans Urlberger

Inventor's signature:  Date

Residence: Kahlenbergsweg 24, 40885 Ratingen, Germany 

Citizenship: German

Post Office Address: Kahlenbergsweg 24, 40885 Ratingen, Germany

Full name of third 3-00
joint inventor, if any: Rudolf Diersch

Inventor's signature: _____ Date _____

Residence: Virchowstrasse 51, 45147 Essen, Germany DE

Citizenship: German

Post Office Address: Virchowstrasse 51, 45147 Essen, Germany

Full name of fourth 4-00
joint inventor, if any: Hermann Stelzer

Inventor's signature: _____ Date _____

Residence: Apolloniastraße 171, 52080 Aachen, Germany DE

Citizenship: German

Post Office Address: Apolloniastraße 171, 52080 Aachen, Germany

Full name of fifth *5-00*
joint inventor, if any: Matthias Patzelt

Inventor's signature: Matthias Patzelt Date 22.11.1999

Residence: Walkmühlstraße 20, 65195 Wiesbaden, Germany *DE*

Citizenship: German

Post Office Address: Walkmühlstraße 20, 65195 Wiesbaden, Germany

Full name of sixth *6-00*
joint inventor, if any: Dieter Methling

Inventor's signature: _____ Date _____

Residence: Kehre 9, 45525 Hattingen, Germany *DE*

Citizenship: German

Post Office Address: Kehre 9, 45525 Hattingen, Germany

D.12102

050655



DECLARATION AND POWER OF ATTORNEY

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Claimed**

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Full name of sole

or first inventor: Klaus-Leo Wilbuer

Inventor's signature:

Date

Residence: Gesundheitsstraße 14a, 42699 Solingen

Citizenship: German

Post Office Address: Gesundheitsstraße 14a, 42699 Solingen

Full name of second

Joint inventor, if any: Hermann Hans Urlberger

Inventor's signature:

Date

Residence: Kahlenbergsweg 24, 40885 Ratingen, Germany

Citizenship: German

Post Office Address: Kahlenbergsweg 24, 40885 Ratingen, Germany

Full name of third
joint inventor, if any: Rudolf Diersch

Inventor's signature: R. Diersch Date 21. 10. 99

Residence: Virchowstrasse 51, 45147 Essen, Germany

Citizenship: German

Post Office Address: Virchowstrasse 51, 45147 Essen, Germany

Full name of fourth
joint inventor, if any: Hermann Stelzer

Inventor's signature: _____ Date _____

Residence: Apolloniastraße 171, 52080 Aachen, Germany

Citizenship: German

Post Office Address: Apolloniastraße 171, 52080 Aachen, Germany

Full name of fifth joint inventor, if any: Matthias Patzelt

Inventor's signature:

Date

Residence: Walkmühlstraße 20, 65195 Wiesbaden, Germany

Citizenship: German

Post Office Address: Walkmühlstraße 20, 65195 Wiesbaden, Germany

THE JOURNAL OF CLIMATE

Full name of sixth joint inventor, if any: Dieter Methling

Inventor's signature:

Date

Residence: Kehre 9, 45525 Hattingen, Germany

Citizenship: German

Post Office Address: Kehre 9, 45525 Hattingen, Germany

St. 3-9

550655



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Inventor's signature:

Date

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Citizenship: German

Post Office Address: Gesundheitsstraße 14a, 42699 Solingen

Full name of second

Joint inventor, if any: Hermann Hans Urlberger

Inventor's signature:

Date

Residence: Kahlenbergsweg 24, 40885 Ratingen, Germany

Citizenship: German

Post Office Address: Kahlenbergsweg 24, 40885 Ratingen, Germany

Full name of third
joint inventor, if any: Rudolf Diersch

Inventor's signature: _____ Date _____

Residence: Virchowstrasse 51, 45147 Essen, Germany

Citizenship: German

Post Office Address: Virchowstrasse 51, 45147 Essen, Germany

Full name of fourth
joint inventor, if any: Hermann Stelzer

Inventor's signature: Hermann Stelzer Date 20 Oct. 1999

Residence: Apolloniastraße 171, 52080 Aachen, Germany

Citizenship: German

Post Office Address: Apolloniastraße 171, 52080 Aachen, Germany

Full name of fifth
joint inventor, if any: Matthias Patzelt

Inventor's signature: _____ Date _____

Residence: Walkmühlstraße 20, 65195 Wiesbaden, Germany

Citizenship: German

Post Office Address: Walkmühlstraße 20, 65195 Wiesbaden, Germany

Full name of sixth
joint inventor, if any: Dieter Methling

Inventor's signature: _____ Date _____

Residence: Kehre 9, 45525 Hattingen, Germany

Citizenship: German

Post Office Address: Kehre 9, 45525 Hattingen, Germany

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_____	_____
_____	_____
_____	_____

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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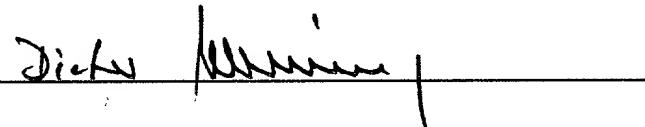
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